Companion Document

City of Kawartha Lakes - Nearshore Monitoring

For Balsam, Cameron, Sturgeon, and Pigeon Lakes

KAWARTHA CONSERVATION

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As part of the City of Kawartha Lakes Lake Management Implementation Action Plan, Kawartha Conservation staff, Citizen Scientists, and researchers from Ontario Tech University sampled the nearshore zone of Balsam, Cameron, Sturgeon, and Pigeon Lake for 2 years (2019 and 2021), monthly from June to September.

The nearshore zone is an area of the lake between the water's edge and the area where sunlight can reach the sediment. This area is the most productive area of the lake for primary producers, i.e., plants and algae, and therefore is the foundation of any food web. Being situated adjacent to land, the nearshore zone is the first area to be impacted by land-based activities and processes such as stormwater runoff, erosion and sediment failures, and spills. It is also the most sensitive area of any waterbody for humans as it is where most interaction with water occurs through recreational and lifestyle activities such as paddling, fishing, wading, and swimming. Lastly, the nearshore zone is often overlooked resulting in data gaps of water quality information. Most water quality monitoring designs take samples directly or as close to the middle of lakes as possible and miss the nearshore zone completely.

A total of fifty-six sites were sampled across the lakes: Balsam (20), Sturgeon (20), Cameron (8), and Pigeon (8) (Figure 1 & 2). This amounted to over three hundred samples collected by Citizen Scientists. Over the course of the sampling years, Citizen Scientist focused on sampling the lake water for nutrients, bacteria, and suspended particles, which were analyzed at Ontario Tech University. The water quality indicators of interest included the following:

Parameter	Description	Common Sources
Phosphorus (Total Phosphorus and Total Dissolved Phosphorus)	An essential nutrient for plant and animal growth. It is often the limiting factor in freshwater systems where too much would trigger excessive plant growth and rapid aging of lakes,	Fertilizer, sewage, stormwater, fecal matter, and septic systems.

	commonly known as eutrophication.	
Nitrogen (Ammonia, Nitrate, Nitrite, Total Organic Nitrogen)	An essential nutrient for plant and animal growth. Excess amounts of some nitrogen species can cause excessive plant and/or bacteria growth and be toxic to aquatic life.	Fertilizer application, sewage, cosmetics, stormwater, industrial salts, and animal feed.
Suspended Solids	Suspended particles are an indicator of poor land management (exposed soils and poor erosion control).	Erosion of soils (wind, runoff), resuspension of lake sediment, and biological particle (plankton, algae).
Escherichia coli (*E. coli*)	Indicator of fecal contamination where harmful pathogens may be found.	Bird colonies, livestock agriculture, septic systems.

Water quality results were compared to the Provincial Water Quality Objectives and the Canadian Water Quality Guideline for the Protection of Aquatic Life.

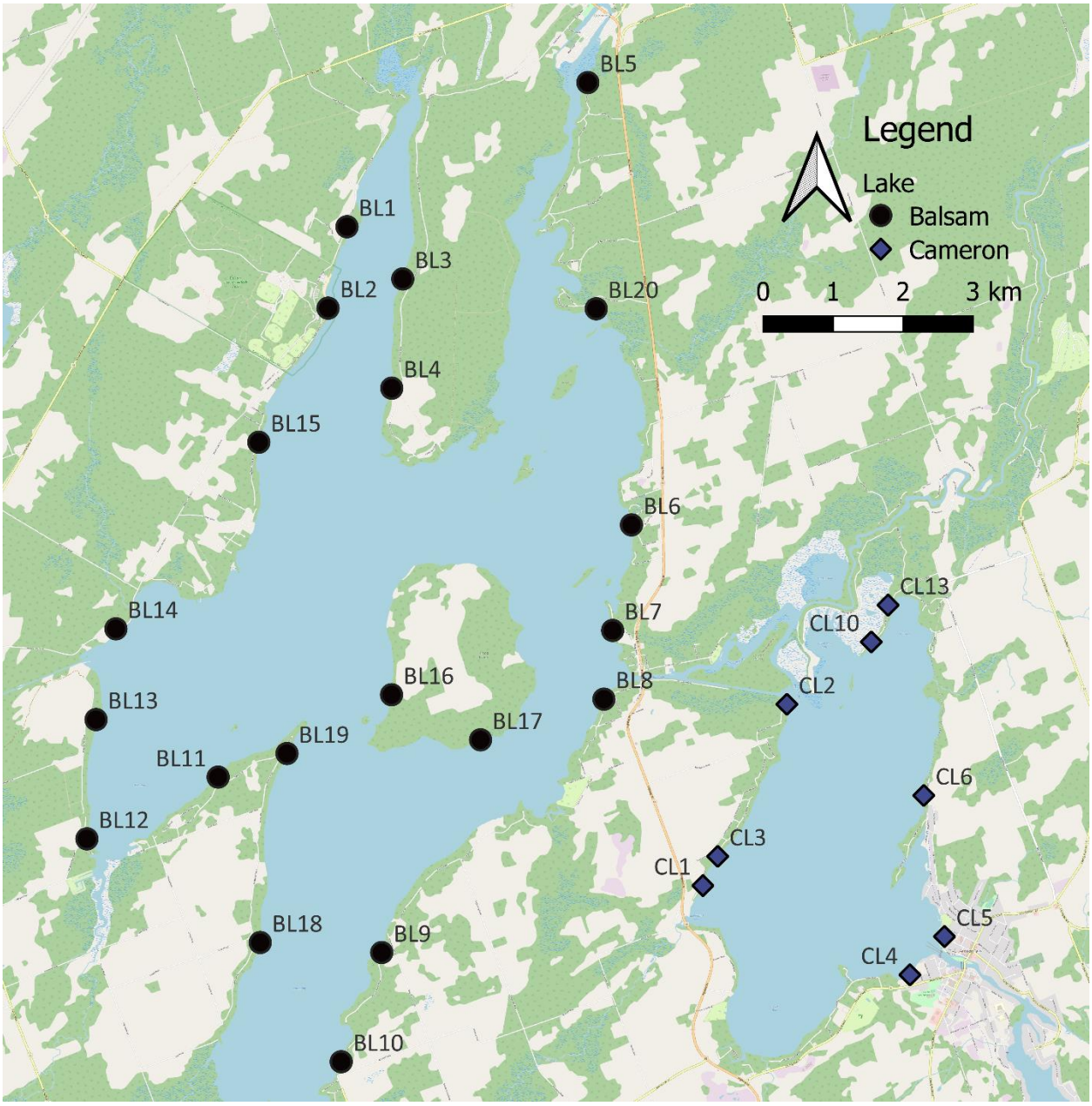

Figure 1. Locations of sampling sites across Balsam Lake (black circles) and Cameron Lake (blue diamonds).

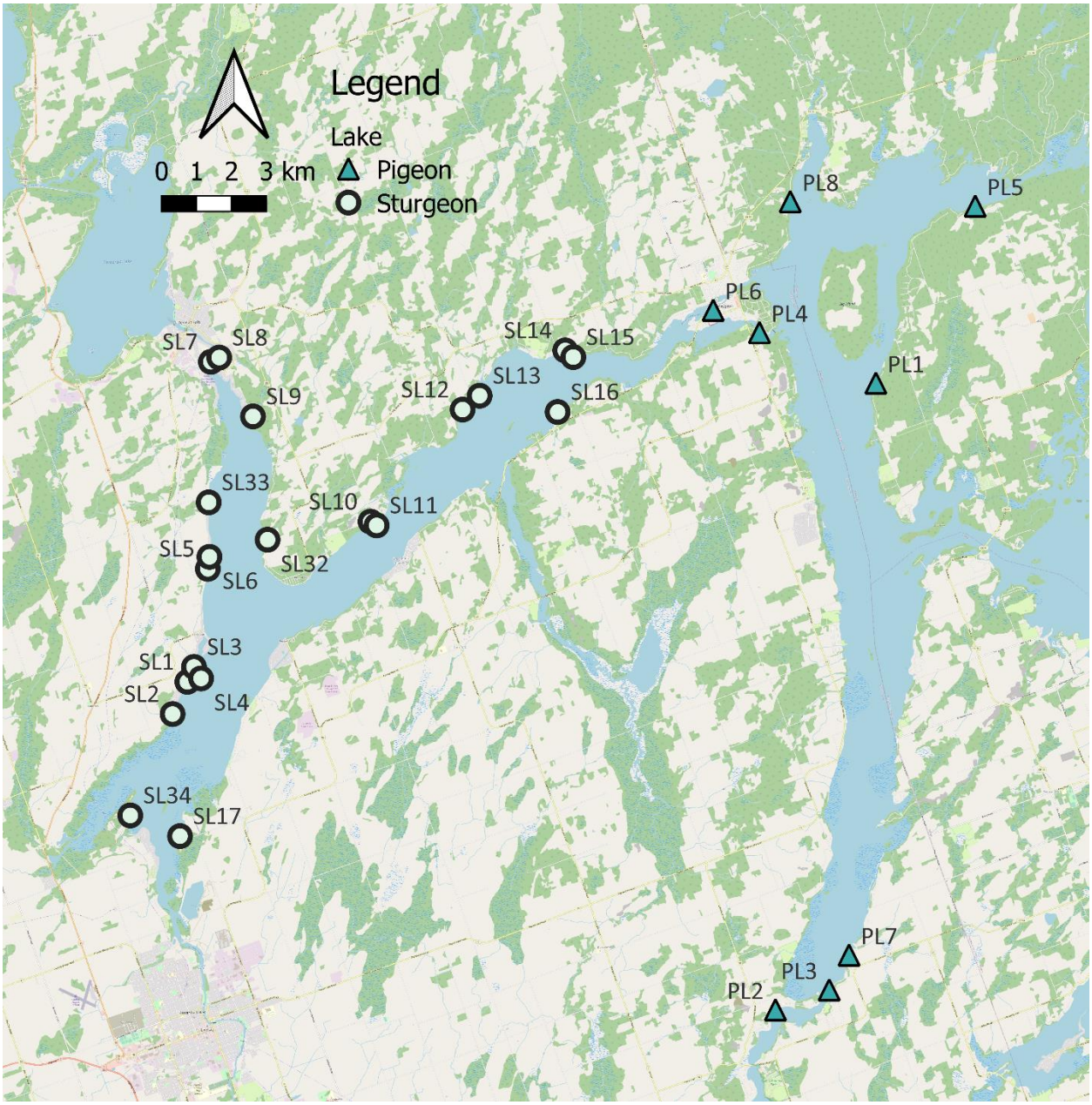

Figure 2. Locations of sampling sites across Sturgeon Lake (light blue circles), and Pigeon Lake (teal triangles).

We found that the nearshore water quality was slightly more nutrient-enriched than those further out in the lake. The lack of natural riparian buffer along the shoreline and upland is most notably the driver of higher phosphorus in the nearshore zone, with more developed shorelines having higher phosphorus concentrations (Smith, 2022).

This was especially clear in Pigeon and Sturgeon Lake, where both lakes had a meaningful relationship between phosphorus and artificial land use (Smith, 2022). This resulted in Pigeon Lake having the highest exceedance percentage (33.3% of all samples), followed by Sturgeon (26.3%). In Sturgeon Lake, higher exceedances were found along the eastern side of the lake with some sporadic sites in the eastern and southern arms which were associated with land development. For Pigeon Lake, the enriched Reforestation Creek may be driving the high Total Phosphorous levels in southern Pigeon Lake. Also, much of the southern portion of Pigeon Lake is shallower, making it an ideal location for an abundance of aquatic plants. These plants temporarily uptake phosphorus during the growing season which is then released back into the water once decomposed. Further enrichment of nutrients can lead to uncontrolled algae and aquatic plant growth. Uncontrolled algae growth can lead to continuous poor water quality and significant impacts on humans and animals that may interact with the water. Uncontrolled plant growth can lead to poor recreational capacity and reduced aesthetics. Balsam and Cameron Lake have lower exceedance rates, 13.4 % and 10%, respectively. Both low rates of exceedances in Balsam and Cameron Lake are the result of large inputs of low nutrient water originating from the Gull and Burnt River (owning to nutrient poor geology of the Canadian Shield).

Water quality results showed no concerns for nitrate and *E. coli*. *E. coli* results suggest that there were no significant impacts on recreational water quality and human health through fecal contamination. Low nitrate results indicate good water quality and minimal risk to aquatic organisms such as fish.

Results for ammonia were mostly within guidelines, with only one site and at one time having a failed observation. This was found in the Town of Bobcaygeon, which is currently in the process of redevelopment to improve ecological function and provide water quality treatment.

For total suspended solids (TSS), Pigeon Lake had the highest number of exceeded observations (44%), followed by Sturgeon (26%), Cameron (19%), and Balsam (7%). These failed observations were found during rain periods, suggesting a

higher input of sediment from stormwater runoff and exposed soils. Continuous exposer to suspended solids in water can affect the gills of fish and smoother spawning habitat. Continuous input of suspended solids in water can also lead to higher contaminant loading as soil particles can bind to excess nutrients and other contaminants such as heavy metals. The lack of aquatic plants was found to be another driver for high TSS during non-rain events. Aquatic plants hold down sediment and reduce wave action from boats, reducing the resuspension of the sediment.

In summary, there are sites in the nearshore zone of all four lakes that show higher levels (exceedances) than those outlined by the Ontario Government and for the protection of aquatic life. These sites are hot spots as they have higher levels of contaminants of concern. For Total Phosphorus, exceedances were focused on the southern portion of Pigeon Lake and along the eastern portion of Sturgeon Lake. Total Ammonia exceedances was centered around one site in Bobcaygeon. As mentioned above, no exceedances were found for nitrate and *E. coli* levels. Levels of Total Suspended Solids were concentrated around heavily boat traffic zones in Cameron and Sturgeon Lake outlet.

Using the information discovered, Kawartha Conservation's Stewardship staff will look for willing landowners to implement nutrient and contaminant reduction projects near the shoreline of these hot spot sites. Contaminant reduction projects may take the form of riparian plantings, rain gardens, agricultural best management practices, or through enacting policies that protect natural areas for nutrient treatment, implementing green technologies and infrastructures, or education and outreach campaigns to educate landowners on ways to treat stormwater and to reduce phosphorus export from their property.

Acknowledgements

We would like to acknowledge that many Indigenous Nations have longstanding relationships, both historic and modern, with the territories upon which we are located. Today, this area is home to many Indigenous peoples from across Turtle Island. We acknowledge that our watershed forms a part of the treaty and traditional territory of the south-eastern Anishinaabeg.

It is on these ancestral and Treaty lands that we live and work. To honor this legacy, we commit to being stewards of the natural environment and undertake to have a relationship of respect with our Treaty partners.

The region of Kawartha Lakes was referred to as Gau-wautae-gummauh, a glistening body of water, in anishinaabemowin. We are thankful to have an opportunity to work with Indigenous Peoples in the continued stewardship and care of this beautiful region.

This report was written by Tanner Liang, Water Quality Specialist, Kawartha Conservation and is based on the work of Smith (2022), which was a collaboration between Ontario Tech University and Kawartha Conservation. Peer editors include Ian McRae, Environmental Communications, Robert Stavinga, Watershed Resource Technician, Nancy Aspden, Acting Manager, Integrated Watershed Management.

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Dr. Andrea Kirkwood	Ontario Tech University
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